U.S. EPA Environmental Technology Verification Program
Environmental and Sustainable Technology Evaluation (ESTE)

Manure Treatment by Anaerobic Digester Technology to Recover Energy and Reduce Pollutants

Impact Statement

Anaerobic digestion of animal manures at large scale animal feeding operations has the potential to reduce waste loads, control microorganisms, and generate energy and salable products. Any or all of these potentials can benefit agriculture in the United States because waste management at large scale feeding operations has become an issue of importance to local communities. Verification of the performance of digesters will help to develop and broaden the appeal of digesters to more farms.

Background

The U.S. Environmental Protection Agency's Office of Research and Development (EPA-ORD) supports Environmental and Sustainable Technology Evaluation (ESTE) to facilitate the development and commercialization of innovative technologies through performance verification and information transfer. In part, ESTE is intended to increase the relevance of Environmental Technology Verification (ETV) program (www.epa.gov/etv) projects to U.S. EPA program offices and regional offices. These performance verifications will serve the public by demonstrating performance of commercial technologies in operation. Stringent quality control measures will be taken to gain credible performance data. Potential customers will be able to refer to reports of verification to help make decisions regarding purchase and use of these technologies.

Large scale animal feeding operations commonly known as concentrated animal feeding operations (CAFOs) generate very large quantities of manure. Most of the manure is spread on farm land both as a fertilizer and as a disposal mechanism. The major problems associated with manure relate to odor production and nutrient content. Many soils of the US are overloaded with phosphorus and adding more from animal manure only makes the problem worse. Similarly, large scale operations have the potential for generating odors that degrade the quality of life in nearby areas. There are also questions about the transport of pathogenic organisms and harmful gases such as hydrogen sulfide from large scale animal waste facilities. Anaerobic digesters operate in the absence of oxygen and can not be open to the atmosphere. In the process, degradable organic matter is converted to methane and carbon dioxide. The methane can be recovered and used to power generators or water heaters on the farm to reduce the farm's dependence on fossil fuel generated electricity. In most cases, a good digester can provide enough methane to generate excess electricity that can be sold to the grid, further reducing the cost of operating a digester. After the digestion process is completed the residual material has much less odor potential and is reduced in total mass. This material can be further composted or dried for other uses, thereby making better overall use of the material. Further processing of the liquid waste stream can recover phosphorus, preventing application of excess phosphorus to farm fields. These factors can combine to make anaerobic digestion of animal waste an attractive waste management practice.

Objective

The objective of this project is to verify the performance of an anaerobic digester in use on a large scale farm. The work planned will examine several reactor performance parameters. Reduction of organic solids, methane generation, energy generation, and reduction of potentially pathogenic microorganisms are included in the measurements planned.

Study Description

Together with an engineering firm that installs anaerobic digesters, the performance of a digester or more than one digester will be evaluated by measuring the manure entering the digester in terms of nutrient content, volatile solids content, microorganism population, and water content. During digestion, the production of methane and carbon dioxide will be measured. If a generator is being used, the power generated from the methane will be measured. The digested material leaving the reactor will be measured for the same components as the influent material. Reduction of mass and organic content will be calculated as will the value of the generated power.

Status

A potential partner has agreed in principle to participate in the evaluation. The stakeholder group is being coalesced and asked to review the draft test/quality assurance (QA) plan. An EPA contractor is being chosen to finalize the test/QA plan after comments are received from the stakeholders and vendor. Possible start time for the evaluation will be August or September, 2006.

Next Step

A conference call with stakeholders and vendor to obtain comments on draft test/QA plan will be held. A contractor will be identified to finalize the test/QA plan, conduct QA audits, conduct data analysis, and write the final report.

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